REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

Claims 13, 23, and 24 have been canceled in favor of new claims 25-27. Support for the new claims is provided at least in claims 13-24, Fig. 2, and the description accompanying Fig. 2 in the specification.

Claims 13 and 21-24 were rejected, under 35 USC §103(a), as being unpatentable over the Applicants' Description of the Related Art. Claims 14 and 15 were rejected, under 35 USC §103(a), as be unpatentable over the Applicants' Description of the Related Art in view of Sugiyama et al. (US 5,862,175). Claims 9 and 10 were rejected, under 35 USC §103(a), as being unpatentable over the Applicants' Description of the Related Art in view of Lee et al. (US 6,259,744). To the extent these rejections may be deemed applicable to the amended and new claims, the Applicants respectfully traverse based on the following points.

New claim 25 recites features of previous claims 13, 17, 19, and 21. The Applicants' Description of the Related Art fails to teach or suggest the feature recited in claim 25 of a plurality of demodulators that demodulate a received signal based on

regions of demodulation patterns to which signal points belong, using demodulation patterns that differ for error detecting units of the received signal.

In an exemplary but non-limiting embodiment of the invention illustrated in application Figs. 3 and 4A-4F, six different demodulation patterns are applied to a received signal to determine the regions of these patterns that overlap a received symbol. Accordingly, the receiver illustrated in application Fig. 2 employs each of six demodulators 113 to apply a different one of the six demodulation patterns illustrated by Figs. 4A-4F, respectively.

If the transmitted symbol is a 64-QAM symbol, then the six demodulators can determine which one of the 64 prospective symbols of the constellation (indicated by black dots in Figs. 3 and 4A-4F) the received symbol is intended to represent. This determination can be made by comparing the six patterns to the received symbol and eliminating, as candidates for the received symbol, all prospective symbols of the constellation within the regions of negative results (i.e., either shaded regions or slanted line regions).

For example, the constellation position of a received symbol may be visually determined with certainty by sequentially comparing the template patterns illustrated in Figs. 4A-4F with

the received symbol and progressively eliminating, as candidates for the position of the received symbol, all prospective symbols of the constellation lying in regions of a particular type (i.e., either shaded or slanted line region) for the particular template.

More specifically, suppose the symbol representing the bit pattern 100000 (i.e., the upper right-most symbol position) in Fig. 3 is transmitted and then received by a communicating party. If the received symbol is compared to the six templates illustrated by Figs. 4A-4F, then the position of the received symbol can be determined with certainty in the following way. Based on the comparison of the received symbol with the pattern of Fig. 4A, all candidate positions for the received symbol within the shaded region (i.e., left side of the vertical axis) are eliminated. Based on the comparisons of the received symbol with the patterns of Figs. 4B-4F, all candidate positions for the received symbol within the slanted-line regions of each pattern are eliminated. According to this process, all candidate positions for the received symbol other than the upper right-most position are eliminated. Therefore, the upper right-most position represents the received symbol.

Now suppose the bit pattern 1000 is transmitted using 16-QAM modulation. The same demodulators and demodulation patterns

discussed above for receiving a 64-QAM modulated signal may similarly be used to identify, with certainty, the particular 16-QAM symbol that was transmitted. By eliminating all prospective 64-QAM symbol candidates in the shaded region of Fig. 6A and all such candidates in the slanted line regions of Figs. 6B-6D, the receiver may determine that the position of the received symbol lies in the upper right one-fourth of the upper-right quadrant. Because the receiver does not realize that the transmitted symbol is actually a 16-QAM symbol, it can only resolve what it believes to be four of the six bits comprising a 64-QAM symbol. Thus, the receiver believes it has received four bits correctly and two bits in error. In actuality though, all four bits comprising the transmitted 16-QAM symbol have been correctly received by the receiver.

Continuing this example, if the transmitter transmits a symbol representing the bit sequence 10 using QPSK, then the receiver will determine that it has received two bits of a 64-QAM symbol correctly and four bits in error (see Figs. 7 and 8A-8F). However, the receiver will actually have received both bits of the QPSK symbol correctly.

The Applicants' Description of the Related Art illustrated in Fig. 1 is incapable of achieving the claimed feature described above, since it employs only two demodulators 14-1 and 14-2.

Demodulator 14-2 demodulates a portion of a received multiplexed signal, presumably using a fixed type of demodulation, to obtain information identifying the particular type of variable modulation used to modulate payload data. Thereafter, demodulator 14-2 conveys the identified form of variable modulation to demodulator 14-1 so that demodulator 14-1 may demodulate another portion of the received multiplexed signal using the identified form of demodulation.

As a result, it is respectfully submitted that the Applicants' Description of the Related Art does not disclose or suggest a plurality of demodulators that demodulate a received signal based on regions of demodulation patterns to which signal points belong, using demodulation patterns that differ for error detecting units of the received signal. More specifically, the demodulators 14-1 and 14-2 do not of the Applicants' Description of the Related Art operate on the same symbol and, therefore, cannot both operate on error detecting units of this symbol. Instead, demodulators 14-1 and 14-2 operate on different signals that are multiplexed together by multiplexer 7. Since the Applicants' Description of the Related Art does not suggest multiple demodulators that all operate on error detecting units of a symbol, it necessarily follows that the Applicants' Description of the Related Art cannot teach using demodulation

patterns that differ for the error detecting units of the received symbol.

Lee is not cited in the Office Action for disclosing the above-discussed feature distinguishing claim 25 from the Applicants' Description of the Related Art. Thus, Lee does not cure the deficiencies of the cited Applicants' Description of the Related Art.

Accordingly, the Applicants respectfully submit that the combined teachings of the Applicants' Description of the Related Art and Lee do not suggest the subject matter defined by claim 25. New claim 26 also recites the above-mentioned feature distinguishing claim 25 from the Applicants' Description of the Related Art. Therefore, allowance of claims 25 and 26 and all claims dependent therefrom is warranted.

To promote a better understanding of the differences between the claimed subject matter and the applied references, the Applicants provide the following additional discussion.

It is a feature of the claimed invention that in a transmitting apparatus, a single modulator modulates transmission data with a number of error detecting units in accordance with a modulation level by a modulation scheme corresponding to the modulation level so that a bit position is specific to each of the error detecting units. Also, in a receiving apparatus, a

plurality of demodulators demodulates reception data based on regions of demodulation patterns to which signal points of bits belong using the demodulation patterns different between the error detecting units, respectively.

An example will be described below using the case of transmitting data with error detecting units A, B, C and D in each of BPSK modulation, QPSK modulation, and 16-QAM modulation. In the case of BPSK modulation, the error detecting units C and D are serially modulated on a bit basis to transmit. For QPSK modulation, the error detecting units A and B are transmitted in parallel with each other, while a bit of the error detecting unit A is a first bit in QPSK modulation and a bit of the error detecting unit B is a second bit in QPSK modulation. Next, the error detecting units C and D are transmitted in parallel with each other, while a bit of the error detecting unit C is a first bit in QPSK modulation and a bit of the error detecting unit D is a second bit in QPSK modulation. Further, in 16-QAM modulation, the error detecting units A, B, C, and D are transmitted in parallel with one another, while a bit of the error detecting unit A is a first bit in 16-QAM modulation, a bit of the error detecting unit B is a second bit in 16-AM modulation, a bit of the error detecting unit C is a third bit in 16-QAM modulation,

and a bit of the error detecting unit D is a fourth bit in 16-QAM modulation.

A demodulation pattern of BPSK modulation, a demodulation pattern of the first bit of QPSK modulation and a demodulation pattern of the first bit of 16-QAM modulation are the same, and therefore, a single demodulator is capable of demodulating these bits even when the modulation schemes are different from one another. Further, using another demodulation pattern, another demodulator is capable of demodulating the second bit of QPSK modulation and the second bit of 16-QAM modulation. Furthermore, using still another demodulation pattern, other of two demodulators are capable of demodulating the third bit and fourth bit of 16-QAM modulation. Thus, according to the invention, in the case of performing adaptive modulation communication, the receiving apparatus is capable of performing demodulation without the need for the transmitting apparatus to notify the receiving apparatus of information such as the modulation scheme and the like.

In contrast thereto, the conventional technique of the invention is different in the method of modulation from the invention. In the Applicants' Description of the Related Art, only a single payload data demodulator exists in the receiving apparatus, and in the case of performing adaptive modulation

communication, the transmitting apparatus needs to notify the receiving apparatus of information such as the modulation scheme and the like.

Sugiyama is also different in the method of modulation from the invention, and only a signal demodulator (differentially coherent detector, coherent detector) exists in the receiving apparatus. Further, the invention of Sugiyama is not aimed at performing adaptive modulation communication.

Further, Lee does not disclose the feature of the invention as described above, either. Thus, the claimed invention is non-obvious over the cited documents.

Accordingly, the Applicants respectfully submit that the applied references do not suggest the subject matter of independent claims 25 and 26. More specifically, the references do not suggest the recited features of receiving at a receiving end a transmission unit and demodulating error detecting units in the transmission unit using different demodulation patterns, respectively, using demodulation patterns that apply to a modulation scheme of the largest prospective modulation level. Therefore, allowance of claims 25 and 26 and all claims dependent therefrom is warranted.

In view of the above, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

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